

1. An apparatus for synchronizing an analog video signal formed of a plurality of associated video frames to a digital image formed of a plurality of pixels displayed on a digital display unit, comprising:

- 5 means for determining a synchronizing horizontal resolution (H_{total}) that includes,
- means for finding a plurality of features for a selected one of a range of H_{total} ;
- 10 means for tracking each of the plurality of features for each of the range of H_{total} ;
- means for measuring a transition zone for each of the plurality of found features for each of the range of H_{total} ;
- means for determining the narrowest transition zone of the plurality of transition zones, and
- 15 means for associating a particular one of the range of H_{total} corresponding to the narrowest transition zone to the synchronizing horizontal resolution; and
- means for determining a synchronizing phase coupled to the means for determining the synchronizing horizontal resolution that includes,
- 20 means for selecting an estimated phase based upon the synchronizing horizontal resolution;
- means for determining a flat region of a video signal corresponding to a selected found feature, and
- means for selecting the synchronizing phase based upon the flat region.

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2. An apparatus as recited in claim 1, wherein the means for finding comprises:

- 30 means for initializing a step value, a region value, and a previous pixel value to a corresponding initial value;
- means for grabbing a pixel value at a location corresponding to the step value plus the region value;

means for setting a current pixel value as the grabbed pixel value; and
means for subtracting the current pixel value from the previous pixel value to
form a pixel value difference.

- 5 3. An apparatus as recited in claim 2, wherein the means for finding
further comprises:

means for determining if the pixel value difference indicates a found feature;
means for storing a set of pixel coordinates as a feature based upon the
10 location;
marking the region as a used region;
incrementing a feature count; and
determining if the feature count is greater than or equal to a pre-selected
feature count.

- 15 4. An apparatus as recited in claim 1, wherein the means for tracking
comprises:

means for initialing a scan value, a feature value to a corresponding initial
20 value;
means for determining if a feature is a found feature;
means for grabbing a pixel value from a location corresponding to the feature
value and the scan value if it is determined that the feature is a not found feature;
means for determining if the feature is a found feature;
25 means for marking the feature as found; and
means for determining if all features are found.

5. A method of synchronizing an analog video signal formed of a
plurality of associated video frames to a digital image formed of a plurality of pixels
30 displayed on a digital display unit, comprising:
determining a synchronizing horizontal resolution (H_{total}) by,
finding a plurality of features for a selected one of a range of H_{total} ;

tracking each of the plurality of features for each of the range of
Htotal;

measuring a transition zone for each of the plurality of found features
for each of the range of Htotal;

5 determining the narrowest transition zone of the plurality of transition
zones, and

associating a particular one of the range of Htotal corresponding to
the narrowest transition zone to the synchronizing horizontal resolution; and

determining a synchronizing phase coupled to the means for determining the
10 synchronizing horizontal resolution by,

selecting an estimated phase based upon the synchronizing horizontal
resolution;

determining a flat region of a video signal corresponding to a selected
found feature, and

15 selecting the synchronizing phase based upon the flat region.

6. A method as recited in claim 5, wherein the finding comprises:

initializing a step value, a region value, and a previous pixel value to a
20 corresponding initial value;

grabbing a pixel value at a location corresponding to the step value plus the
region value;

setting a current pixel value as the grabbed pixel value; and

subtracting the current pixel value from the previous pixel value to form a
25 pixel value difference.

7. A method as recited in claim 6, wherein the means for finding further
comprises:

30 determining if the pixel value difference indicates a found feature;

storing a set of pixel coordinates as a feature based upon the location;

marking the region as a used region;

incrementing a feature count; and

determining if the feature count is greater than or equal to a pre-selected feature count.

8. A method as recited in claim 5, wherein the means for tracking
5 comprises:

initializing a scan value, a feature value to a corresponding initial value;
determining if a feature is a found feature;
grabbing a pixel value from a location corresponding to the feature value and
10 the scan value if it is determined that the feature is a not found feature;
determining if the feature is a found feature;
marking the feature as found; and
means for determining if all features are found.

9. A method as recited in claim 5, wherein the measuring a transition
15 zone comprises:

initializing a phase, a feature value, and a feature change value to a
corresponding initial value;
20 selecting one of the plurality of found features;
grabbing a pixel from the selected feature;
determining if the selected feature moved;
if the selected feature moved, then incrementing the feature change value; and
if the feature change value is equal to 1, then storing the phase as a transition
25 start value.

10. A method as recited in claim 9, wherein the measuring further
comprises:

if the feature change in not equal to 1, then determining if the feature change
30 value is equal to the feature value;
if the feature change value is equal to the feature value, then storing the phase
as a transition end value; and
subtracting the transition start value from the transition end value.

11. An analog to digital synchronizer for synchronizing an analog video signal formed of a plurality of associated video frames to a digital image formed of a plurality of pixels displayed on a digital display unit, comprising:

a video signal evaluator arranged to provide an estimate of the synchronizing resolution;

a feature finder unit arranged to find a feature, if any, associated with a pseudo-randomly selected pixel;

a transition zone generator unit coupled to the feature finder unit arranged to generate a transition zone associated with the found feature based upon the estimated synchronizing resolution; and

a minimum transition zone evaluator unit coupled to the transition zone detector for evaluating a minimum transition zone corresponding to the synchronizing resolution.

12. An apparatus as recited in claim 11, wherein the pseudo-randomly selected pixel is one of a plurality of pseudo-randomly selected pixels in a video frame each of which is associated with a region of the video frame.

13. An apparatus as recited in claim 12, wherein each of the regions is formed of a group of associated pixels.

14. An apparatus as recited in claim 13, wherein the group of associated pixels is a group of associated horizontal pixels.

15. An apparatus as recited in claim 14, wherein the synchronizing resolution is a horizontal resolution formed of a total number of horizontal pixels that span the displayed video frame.

16. An apparatus as recited in claim 15 wherein the feature finder comprises:

5 a horizontal resolution scanner unit arranged to provide a range of horizontal resolutions based upon the estimated horizontal resolution;

a feature tracker unit coupled to the horizontal resolution scanner unit arranged to track the found feature for each of the range of horizontal resolutions; and

10 a phase scanner unit coupled to the feature tracker unit arranged to provide a range of phases based upon the estimated resolution.

17. An apparatus as recited in claim 16, wherein the transition zone generator comprises:

15 a found feature counter unit arranged to provide a number of found features for each of the range of phases; and

a found feature accumulator unit coupled to the found feature counter unit arranged to provide a change in the number of found features corresponding to the range of phases, wherein the transition zone spans the range of phases corresponding to the change in the number of found features substantially equal to the total number of found features; and